Anatomical and clinical characteristics of percutaneous coronary intervention after stent implantation in China

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Abstract: Objective: To investigate the anatomical and clinical characteristics of percutaneous coronary intervention after stent implantation. Methods: 275 elderly patients with coronary heart disease diagnosed by coronary angiography and undergoing percutaneous coronary intervention (PCI) were enrolled in this study. They were divided into male group (158 cases) and female group (117 cases) according to gender. To analyze the anatomical abnormal coronary artery and summarize the percutaneous coronary intervention treatment of abnormal origin and narrow coronary artery. Results: The basic clinical features of the two groups were similar. However, the number of women with type 2 diabetes is significantly higher than that of men, with significant statistical difference; The total success rate of percutaneous PTCA in 275 patients with coronary heart disease was 96.4%, and the success rate of treating lesions was 93.4%. There was no significant difference between male and female in coronary artery distribution ($P > 0.05$). There was no difference between male and female in detecting anatomical variation of coronary artery ($P > 0.05$). Compared with the results of two-year follow-up, there was no significant difference in recurrence rate of angina pectoris, readmission rate, repeated revascularization of target lesion and serious adverse cardiac events between the two groups $P > 0.05$). Conclusion: Type 2 diabetes mellitus is more common in elderly women with coronary heart disease. The coronary artery lesions in both groups were mainly double-branch and three-branch lesions, and were characterized by B2 and C lesions. PCI is safe and feasible for coronary artery stenosis with abnormal origin.

1. Introduction

Coronary heart disease is a common and frequently-occurring disease in the elderly. Epidemiological investigation shows that the incidence of coronary heart disease in women is lower than that in men [1]. However, with the increase of age, the incidence of coronary heart disease in women is gradually close to that in men. It was found that the clinical prognosis of female patients with coronary heart disease who received interventional therapy was worse than that of male patients, which was related to the older age and poor basic clinical status of female patients [2-3]. Recent studies have confirmed that with the improvement of interventional therapy level, interventional therapy is safe and effective for elderly patients with coronary heart disease [4-5]. The rise and development of PCI (Percutaneous Coronary Intervention) technology has opened up a new field of treatment for coronary heart disease, which has obviously improved the clinical symptoms of patients with coronary heart disease and improved their quality of life and survival rate.

Heart stent, also known as coronary stent, is a consumable used for PCI. It is a rapid and effective treatment to improve the condition of coronary heart disease by minimally invasive intervention technology to "stab" the stent through the femoral artery or radial artery of the patient to the coronary artery of the heart with severe stenosis. Evidence-based medicine proves that PCI can reduce death and reinfarction more effectively and benefit patients. However, the success rate and mortality of PCI for different genders are not the same. In this paper, the anatomical and clinical characteristics of percutaneous coronary intervention (PCI) for female and male patients

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with coronary heart disease after stent implantation were comparatively analyzed, in order to know more about the clinical characteristics of female and male patients with coronary heart disease and the short-term and long-term effects of PCI.

2. Materials and methods

2.1. Object of study

From May 2019 to July 2020, 275 patients with coronary heart disease diagnosed by coronary angiography and undergoing percutaneous coronary intervention (PCI) were admitted to the cardiovascular hospital from May 2019 to July 2020, aged 70 to 88 years old, with an average age of (72. 73 ± 3. 127) years old. According to gender, there were 158 cases in the male group, with an average age of (72. 68 ± 3. 60) years; 117 cases in the female group, with an average age of (72. 55 ± 3. 338) years. There was no difference in age between the two groups (P ＞ 0. 05).

2.2. Method

Selective coronary angiography was performed in 275 patients with suspected or confirmed coronary heart disease. All subjects were used INNOVA2000/2000S digital subtraction angiography, and Judkins puncture was used for coronary angiography via femoral artery or radial artery [6]. According to the angiographic results, quantitative computer analysis (QCA) system was used to measure the degree of coronary artery stenosis, and PCI was performed in patients with stenosis greater than or equal to 75%.

2.3. Criteria for judging coronary artery distribution superiority

According to Schlesinger's classification principle, the source of posterior interventricular branch is regarded as the classification standard of coronary artery distribution types: (1) right dominant type: the right coronary artery originates from the posterior interventricular branch on the diaphragm surface of the heart, and has branches distributed in the whole right ventricular diaphragm surface and part or all of the left ventricular diaphragm surface; (2) Balanced type: the diaphragm surfaces of both ventricles are supplied by the same coronary artery, which does not cross the atrioventricular junction, and the posterior interventricular branch is the end of the left or right coronary artery or comes from both coronary arteries; (3) Left dominant type: The left coronary artery distributes not only the left ventricular diaphragm, but also the posterior interventricular branch distributed on the right ventricular diaphragm.

2.4. Judgment of abnormal origin of coronary artery

The abnormal origin of the opening of left main coronary artery (LM), anterior interventricular branch (LAD), circumflex branch (LCX) and right coronary artery (RCA) was judged as abnormal origin of coronary artery, and branches such as conical branch originated from anterior interventricular branch and sinus node branch originated from right coronary artery were excluded.

2.5. Visit as a member of an entourage

All postoperative patients were evaluated by clinical follow-up during hospitalization, 6 months and 2 years. Serious adverse cardiac events were observed, including death, myocardial infarction, late stent thrombosis, emergency coronary artery bypass grafting and repeated vascular reconstruction of target lesions. Twelve months after operation, 258 patients (93.8%) received repeated coronary angiography study. The minimum lumen diameter and restenosis at the lesion were determined by quantitative coronary angiography (QCA).

2.6. Statistical method

SPSS 20. 0 statistical software was used to process the data. The measurement data conforming to normal distribution is expressed by mean standard deviation ($\bar{x} \pm s$), and the independent sample T test is used for comparison between groups. The use case (percentage) of counting data indicates that $\chi 2$ test or Fisher exact test is used for comparison between groups. $P < 0.05$ was the difference

with statistical significance.

3. Result

3.1. Comparison of general clinical data and risk factors

The basic clinical features of the two groups were similar. However, the number of women with type 2 diabetes was significantly higher than that of men ($p < 0.01$). The smoking rate was 64.6% in male group and 7.7% in female group, with significant difference ($p < 0.001$). See table 1.

Table 1 Comparison of basic clinical characteristics between two groups of elderly patients with coronary heart disease undergoing PCI

Group	n	Age	Hypertension	Hyperlipoidemia	Type 2 diabetes mellitus	History of smoking
Male group	158	72. 68 ± 3. 60	121(76.6)	71(44.9)	49(31.0)	102(64.6)
Female group	117	72. 55 ± 3. 338	68(58.1)	45(38.5)	31(26.5)	9(7.7)
P value		0.533	0.103	0.031	0.005	0.00

3.2. PCI results

In 275 patients with coronary heart disease, the total success rate of percutaneous PTCA was 96.4%, the success rate of treating lesions was 93.4%, the success rates of type A, type B and type C lesions were 100%, 100% and 90.1% respectively, the success rate of completely occluded lesions was 66.3%, and 34 cases (12.8%) underwent staged PCI. 159 patients underwent intracoronary stent implantation, and 149 drug-eluting stents were implanted in coronary artery. The success rate of stent implantation was 93.7%.

3.3. Distribution of dominant types of coronary artery

In 275 cases, the dominant type of coronary artery distribution was 85.4%(135 cases), the dominant type was 20.9%(33 cases), and the balance was 12.1%(19 cases). See Table 2 for the distribution of males and females. There was no significant difference between male and female in coronary artery distribution ($P > 0.05$).

Table 2 Distribution of dominant coronary artery types n(%)

Gender	n	Right dominant type	Left dominant type	Balanced type
Male group	158	89(56.3)	45(28.5)	24(15.2)
Female group	117	61(52.1)	33(28.2)	23(19.7)
		>0.05	>0.05	>0.05

3.4. Anatomical variation of coronary artery

Among 275 patients with coronary angiography, there were 12 cases of anatomical variation (Table 3), including 8 males (66.7%) and 4 females (33.3%). As far as the overall research subjects are concerned, 65.27% of male cases and 34.73% of female cases, so there is no difference between male and female in detecting anatomical variation of coronary artery ($P >0.05$).

Table 3 Anatomical variation of coronary artery

Anatomical variation types of coronary artery	Number of cases	Detection rate of angiography (%)	Composition ratio (%)
The RCA opening is located in the left coronary sinus	4	0.32	33.3
The RCA opening is located in the coronal sinus	1	0.01	8.3
Single left coronary artery	2	0.02	16.7
Coronary artery pulmonary fistula	1	0.01	8.3
Coronary artery left ventricular fistula	2	0.02	16.7
Left atrial fistula of coronary artery	1	0.01	8.3
Coronary arteriovenous fistula	1	0.01	8.3

3.5. Comparison of follow-up results after interventional therapy

The 6-month follow-up results showed that there was no significant difference between the two groups in recurrence rate of angina pectoris, readmission rate, repeated revascularization of target lesion and serious adverse cardiac events (acute myocardial infarction, late stent thrombosis and death) ($p > 0.05$). Comparison of 2-year follow-up results: the recurrence rate of angina pectoris, readmission rate, repeated vascular reconstruction of target lesions and serious adverse cardiac events between the two groups were not statistically different ($p > 0.05$).

4. Discussion

With the development of China's social economy and the acceleration of population aging, the incidence of hypertension, diabetes and other diseases is increasing year by year, and coronary heart disease has become a major problem that seriously threatens human health. In recent years, PCI and coronary artery bypass grafting (CABG) are important methods to treat coronary heart disease.

Known risk factors of coronary atherosclerosis include age, sex, smoking, hypertension, hyperlipidemia, diabetes, etc. According to Framingham research, traditional risk factors such as hypertension, dyslipidemia, diabetes and smoking have a strong predictive effect on women aged 55-69 [7]. In this study, 275 elderly patients with coronary heart disease (aged ≥70 years) hospitalized at the same time were analyzed by gender. It was found that the number of women with type 2 diabetes was significantly higher than that of men, and the smoking rate of men was significantly higher than that of women. These results suggest that type 2 diabetes may be one of the main risk factors affecting elderly women with coronary heart disease.

For the dominant types of coronary artery distribution, Schlesinger's classification principle is generally adopted, and the source of posterior interventricular branch is taken as the classification standard of coronary artery distribution types. According to the literature reports in Europe and America, the right dominant type of coronary artery accounts for 85%. The results of this study show that the distribution of coronary artery in Chinese coronary angiography population is also dominated by the right dominant type, accounting for 66.7%, slightly higher than them. There was no significant difference between men and women in different distribution dominance types ($P > 0.05$). According to previous literature reports [8-9], the total detection rate of anatomical variation of coronary artery in coronary angiography population is 0.82%~1.20%. Abnormal origin of left coronary artery is more common than that of right coronary artery, especially the left circumflex branch originated from right coronary artery or right coronary sinus. The results of this study show that the abnormal origin of the right crown is the most common, and the most common origin is the left crown sinus, with a detection rate of 0.32%, accounting for 25.17% of the total composition ratio [10~11], which is consistent with most reports in China and higher than those reported abroad.

It has been reported that compared with elderly patients, coronary heart disease is more common in young patients, and most of the lesions are single-vessel lesions [12]. Most young patients are first onset, with short history of angina pectoris before myocardial infarction, no ischemic preconditioning process, and usually fail to establish effective collateral circulation. Therefore, coronary heart disease is the main cause of AMI; With the increase of age, the physiological function of elderly patients regresses, and the exposure time under various risk factors is longer, which leads to the more serious number of coronary vessels involved and the degree of pathological changes. In this paper, the proportion of risk factors in patients with coronary heart disease is relatively high, and the coronary artery lesions are complex, most of which are diffuse lesions with multi-vessel lesions and calcification. The total success rate of percutaneous PTCA in 275 patients with coronary heart disease is 96.4%, the success rate of treating lesions is 93.4%, the success rates of A, B and C types are 100%, 100% and 90.1%, respectively, and the success rate of complete occlusion lesions is 66.3%. PCI by stages. 159 patients underwent intracoronary stent implantation, and 149 drug-eluting stents were implanted in coronary artery. The success rate of stent implantation was 93.7%, and satisfactory results were achieved. It is difficult to open blood vessels in interventional therapy of complex diseases, and its success rate is relatively low, while the rate of

late restenosis and reocclusion is obviously increased, so it has become one of the biggest difficulties and challenges in PCI field at present [13-14].

The clinical follow-up data of this study showed that the incidence of serious adverse cardiac events (AMI, late stent thrombosis and death) was relatively low during the 6-month and 2-year follow-up. No death occurred during the 6-month follow-up, and the number of deaths increased during the 2-year follow-up. The reason may be related to the patient's old age, severe basic coronary artery disease and more accompanying diseases.

5. Conclusions

The results of this study show that elderly women with coronary heart disease have more type 2 diabetes mellitus; The coronary artery lesions in both groups were mainly double-branch and three-branch lesions, and were characterized by B2 and C lesions. Female patients with coronary heart disease are older, complicated with more risk factors than male patients, and the short-term and long-term mortality after PCI is higher than that of male patients. After adjusting for other influencing factors, gender is not the cause of short-term effect, but female is the influencing factor of long-term effect.

References

[1] Han, S, Gyung-Min, P, Yong-Giun, K, Mahn-Won, P, Ho, H. S, & Seung-Whan, L, et al. (2018). Trends, characteristics, and clinical outcomes of patients undergoing percutaneous coronary intervention in korea between 2011 and 2015. Korean Circulation Journal, vol. 48, no. 4 , pp. 310.

[2] Khalid, U, Bandeali, S, Jones, P. G, Virani, S. S, & Alam, M. (2019). Prescription patterns of clopidogrel, prasugrel, and ticagrelor after percutaneous coronary intervention with stent implantation (from the ncdr pinnacle registry). The American Journal of Cardiology, vol. 124, no. 12, pp. 1807-1812.

[3] Tang, X. F, Gao, Z, Xu, J. J, Song, Y, & Yuan, J. Q. (2017). [clinical characteristics and prognosis in the patients of stroke after percutaneous coronary intervention]. Zhonghua Yi Xue Za Zhi, vol. 97, no. 39 , pp. 3051-3056.

[4] Jiang, Y. J, Han, W. X, Chao, G, Feng, J, Chen, Z. F, & Zhang, J, et al. (2017). Comparison of clinical outcomes after drug-eluting stent implantation in diabetic versus nondiabetic patients in china: a retrospective study. Medicine, vol. 96, no. 17 , pp. e6647.

[5] Chai Renjie, Zhang Bin, Liu Ningning, Zhou Yi, Luo Bingzheng, & Huang Zehan. (2020). Comparison of long-term clinical outcomes after percutaneous coronary intervention between in-stent restenosis and de novo chronic total occlusion. South China Journal of Cardiology, vol. 21, no. 01, pp. 10-15.

[6] Zhang Jun, Li Jun, Zhang Dongxia,&Shi Yu. (2017). Relevant research of serum hs-crp and ctrp 9 on in-stent restenosis after percutaneous coronary intervention. Journal of North Sichuan Medical College, vol. 032, no. 006 , pp. 926-929.

[7] Deepa, Lalwala, Manoj, Deshmukh, Shruti, & Mehta, et al. (2017). Coronary stent infection: a rare but severe complication of percutaneous coronary intervention. Journal of Cardiovascular Diseases & Diagnosis, vol. 6, no. 5 , pp. 1-3.

[8] Gargiulo, G, Valgimigli, M, Capodanno, D, & Bittl, J. A. (2017). State of the art: duration of dual antiplatelet therapy after percutaneous coronary intervention and coronary stent implantation – past, present and future perspectives. Eurointervention, vol. 13, no. 6 , pp. 717-733.

[9] Dorofeeva, N. P, Orekhova, Y. N, Ter-Akopyan, A. O, Ivanchenko, D. N, & A. S. Pleskachev. (2018). Quality of life dynamics in patients with ischemic heart disease after percutaneous coronary intervention with stent implantation. Journal of Clinical Practice, vol. 9, no.3 , pp. 10-15.

[10] Rishi, Kumar, Gupta, Simmi, Manocha, & Subrat, et al. (2019). Clinical characteristics and outcomes of percutaneous coronary intervention in patients with stemi: a single-center experience. The Journal of the Association of Physicians of India, vol. 67, no.1 , pp. 40-43.

[11] Kubo, S, Otsuru, S, Habara, S, Tada, T, & Kadota, K. (2018). Chronic inflammatory disease and long-term clinical outcomes after percutaneous coronary intervention in very young adults. Journal of the American College of Cardiology, vol. 71, no.11 , pp. A78.

[12] Li, S, Luo, C, & Chen, H. (2021). Risk factors of in-stent restenosis in patients with diabetes mellitus after percutaneous coronary intervention: a protocol for systematic review and meta-analysis. Medicine, vol. 100, no.15 , pp. e25484.

[13] Joo, H. J, Ahn, S. G, Park, J. H, Park, J. Y, Hong, S. J, & Kim, S. Y, et al. (2018). Effects of genetic variants on platelet reactivity and one-year clinical outcomes after percutaneous coronary intervention: a prospective multicentre registry study. Scientific Reports, vol. 8, no.1 , pp. 1229.

[14] Joon, J. H, Saem, J. H, Hyungdon, K, Hun, L. S, Hyoung, P. J, & Hong, S. J, et al. (2018). Impact of hyperuricemia on clinical outcomes after percutaneous coronary intervention for in-stent restenosis. Bmc Cardiovascular Disorders, vol. 18, no.1 , pp. 114.